APO-NIKKOR LENSES

Apo-Nikkor lenses are especially designed for use in photoengraving work. The following symmetrical types for various focal lengths are available.

Table 1

Focal length		Maximum aperture	Image area diagonal covered at 1:1 reproduction ratio	
240mm	9 1/2″	f/9	400mm	16″
360	14	f/9	600	24
420	16 1/2	f/9	700	27
480	19	f/9	800	30
610	24	f/9	1,010	40
760	30	f/11	1,170	46

Besides the symmetrical type Apo-Nikkor lenses listed above, **asymmetrical type** Apo-Nikkor lenses with the following characteristics are available:

Table 2

Focal length		Maximum aperture	Image area diagonal covered at 1:1 reproduction ratio
150mm	6″	f/9	250mm
210	8 1/4	f/9	350
300	11 3/4	f/9	450
450	17	f/9	600
600	23 1/2	f/9	800
750	29 1/2	f/9	1,000
900	35 1/2	f/9	1,200
1,200	47 1/4	f/9	1,600
1,800	70 3/4	f/14	2,300

A full series of lenses enable users to obtain good results in any kind of photoengraving.

General Features of Apo-Nikkor

1. Special lenses are required in photoengraving work, because the subject is usually at a close distance, corresponding to a reproduction ratio of 1:1. Therefore, the aberration correction for the photoengraving lens has to be designed for this requirement.

The Apo-Nikkor is corrected for highest performance within a wide reproduction ratio range around 1:1 which is adopted as the standard magnification.

2. The maximum aperture ratio is 1:9 (1:11 in 760mm lens and f/14 in 1,800mm lens) at which sufficiently sharp images are obtained. Even when the aperture is stopped down, the image is maintained in the same position, so that focusing can be done at maximum brightness.

The highest sharpness will be attained when the aperture is stopped down by 2—3 stops from the maximum.

When the aperture is reduced by two stops, a uniformly bright image area will be obtained without vignetting at the corners of the image field. The degree of brightness differs according to type of lens and magnification used.

Note:

When a particularly high resolution is required, it is not recommended to use the lens with the diaphragm stopped down too far, otherwise the increased diffraction will result in lowering of the resolution.

3. An outstanding feature on the design of the Apo-Nikkor is the careful distortion correction made on aberrations, to ensure a faithful form of image.

Since the distortion is corrected to almost zero in full size photography, the lenses are ideal for accurate photographing of patterns.

4. The Apo-Nikkor corrects chromatic aberrations for three colors, red, green and blue, thus covering the whole range of visible light, unlike the ordinary achromatic lens where the correction is accomplished for only two colors, red and blue. Also, the image size difference according to the color is almost zero. Therefore, in color separation work, where photographs of more than three colors are taken with color filters, the same size of image can be attained on each plate with perfect coincidence of the images.

5. Because the photographic plate differs from the human eye in sensitivity to colors, the chromatic aberrations of all Apo-Nikkor lenses have been strictly corrected beyond the visible range of light into near-ultraviolet, so that a sharp image will be

obtained on an emulsion which is most sensitive to near-ultraviolet light when focusing with the eye.

Since the original in the photoengraving is always motionless and brightness is achieved with illumination, the lens aperture does not require to be very large (in fact, f/11 is usually adequate).

Nevertheless, it is difficult to produce photoengraving lenses of high quality which fulfill the above mentioned requirements. This is why few manufacturers make such lenses.

Special Features

Symmetrical Type Apo-Nikkor

Each Apo-Nikkor of symmetrical type, consisting of a symmetrically arranged optical system comprising 4 groups and 4 elements of lenses, has the following features:

1. The lenses will give a wide effective picture angle (about 46°) for their long focal length. Therefore, the image area being assumed the same, a camera of shorter length can be used.

2. Since the lens system is symmetrical in respect to the iris diaphragm, the optical performance remains the same, regardless of the direction in which the lens is used. No need to reverse the lens for magnification. This greatly facilitates the use of the lenses mounted on the camera with automatic focusing device.

3. The lenses are also suitable for work, where no distortion is permissible at a reproduction ratio close to full size. On the other hand, since the lenses give an excellent image, for a wide picture angle at infinite distance as well as in enlarging work, they can also be utilized for a large size camera or on an enlarger.

Asymmetrical Type Apo-Nikkor

The asymmetrical type Apo-Nikkor lenses are intended primarily for reproduction of Japanese and Chinese characters. They have a rather narrow picture angle in order to attain highest resolving power. They can also be used as reproduction lenses in electrostatic photography and microphotography, as enlarging lenses for color and monochromatic photography, and in connection with general purpose cameras like view-cameras and studio-cameras.

Barrel of Apo-Nikkor

The lens barrel of all the Apo-Nikkor lenses is provided with a front cap with hinge and slip-on rear cap. The cap is detachable with its ring from the lens and in place the reversing or roof prism or mirror can be attached. The barrel is provided with a slot for inserting a waterhouse plate and a diaphragm with openings of different shapes to achieve special effects. A gelatine filter with clip can also be inserted.

Considering the recent development of automatic aperture control in cameras, the Apo-Nikkor will be supplied with an iris diaphragm ring featuring screw holes and an equidistantly spaced aperture scale.

The lens has a base plate with six screw holes and is attached to the camera with bolts or screws.

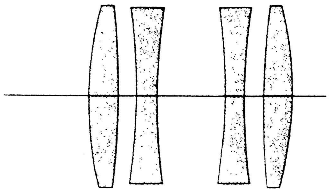
Each lens is provided with an iris diaphragm at the center which enables continuous change of the aperture. The f-numbers are engraved as shown in (a) in Fig. 6 (Nomographs). The aperture diameter reduces by $1/\sqrt{2}$ by stopping down the diaphragm every three graduations and the amount of light entering the aperture will be reduced by 1/2. Supplied with a set of several waterhouse plates and frame for gelatine filter.

The small center hole on the waterhouse plate can be adjusted to the desired shape and size.

Note:

As the photoengraving technology is being applied in different industries, the Apo-Nikkor will have to be modified to suit the purposes. For example, it will be necessary to correct distortion to a specified degree or to bring out the highest performance at a specified magnification or to change the construction of the iris diaphragm or to build in a shutter. For users who are interested in a special field, our consultations will be always available.

Symmetrical Type Apo-Nikkor



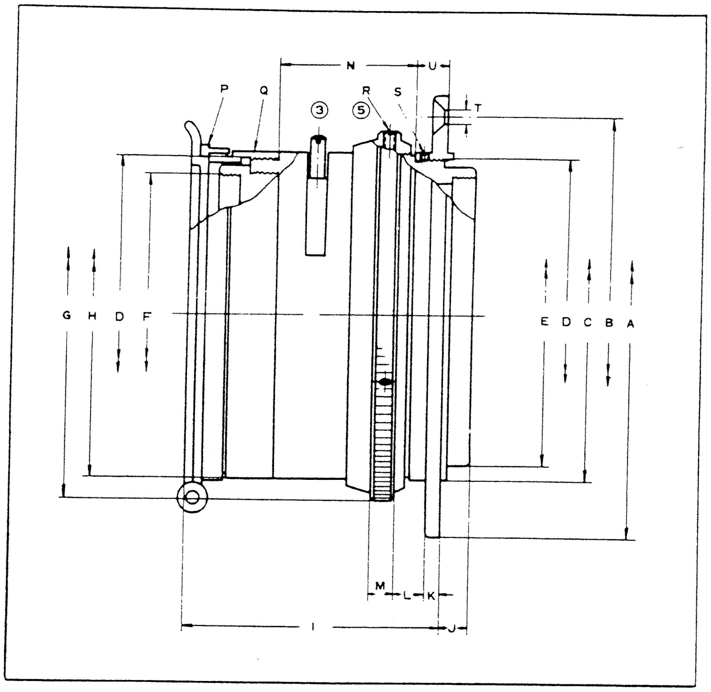


Fig. 1 **Diagram for Symmetrical Type Apo-Nikkor 360mm**

R: Screw hole for attaching accessory
S: Set screw on the base plate

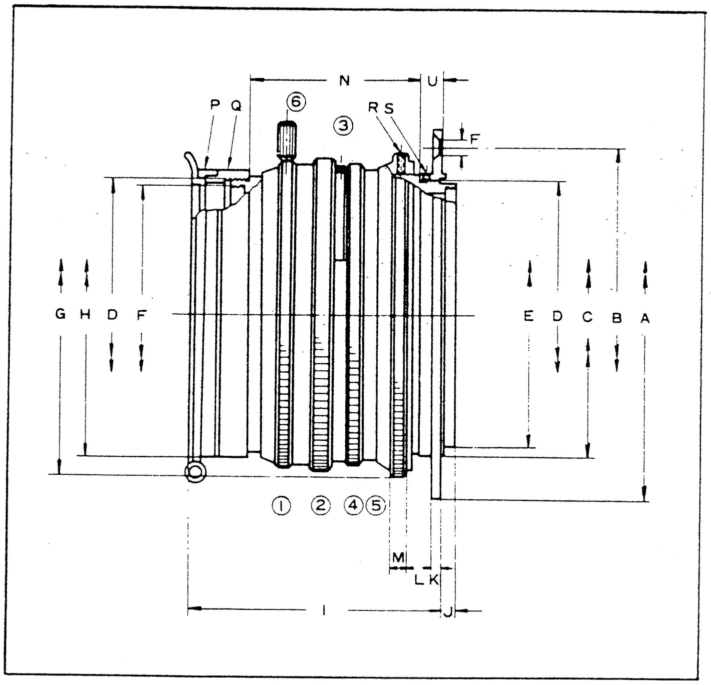


Fig. 2 **Diagram for Symmetrical Type Apo-Nikkor 240mm, 420mm, 480mm, 610mm and 760mm**

1. Rotary angle ring of square type iris diaphragm
2. Square type iris diaphragm ring
3. Slit for inserting waterhouse plate
4. Slit cover
5. Circular iris diaphragm ring
6. Lock for rotary angle ring of square type iris diaphragm

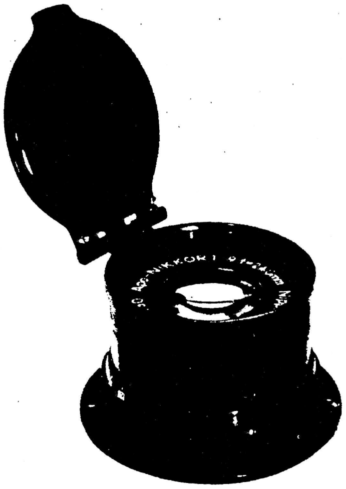
Table 3 **Symmetrical Type**

(unit mm)

Symmetrical type Apo-Nikkor	Dimensions of lens barrel																Diaphragm ring rotating angle	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	T	U	Circular opening	Square opening
240mm f/9	74	67	55	53×0.75	50	47×0.5	62	55	44	4	2.5	5.5	4	23	2.6	5.5	133°30′	Not provided
360mm f/9	98	88	74.5	72×1	70	68×0.75	86	74.5	66.1	3.5	2.5	5.5	4	45	4	5.5	133°30′	63°3′
420mm f/9	121	109	94	90×1	88	86×0.75	105	94	68.1	7	3	11	7	40.5	4	6	127°	Not provided
480mm f/9	121	109	94	90×1	88	86×0.75	105	94	67	7	3	6.5	7	40.5	4	6	133°30′	"
610mm f/9	145	131	114	110×1	108	105×0.75	127	114	79.8	12.7	4	13	7	49.1	4	8	133°30′	"
760mm f/11	145	131	114	110×1	108	105×0.75	127	114	79.9	9.7	4	13	7	49.1	4	8	121°30′	"

Symmetrical Type **Apo-Nikkor**

TYPE OF LENSES DESCRIPTION	240mm f/9	360mm f/9	420mm f/9
Focal length	240mm	356mm	419.1mm
Max. aperture	f/9	f/9	f/9
Construction	4 elements 4 groups	4 elements 4 groups	4 elements 4 groups
Picture angle	46°	46°	46°
Standard magnification	1×	1×	1×
Range of magnification	1/∞—∞	1/∞—∞	1/∞—∞
Overall working distance	960mm	1,440mm	1,680mm
Object area (at 1:1)	400mm	600mm	700mm
Image area (at 1:1)	400mm	600mm	700mm
Correction wavelength range	380—750m〃	380—750m〃	380—750mμ
Vignetting	0% at f/16	0% at f/16	0% at f/16
Aperture scale	9—128	9—128	9—128
Mount	Screw d=53mm p=0.75mm	Screw d=72mm p=1mm	Screw d=90mm p=1mm
Dimensions max. diameter	62mm	86mm	105mm
max. length	49mm	74.5mm	74mm
Weight	205g	540g	755g


240mm f/9

360mm f/9

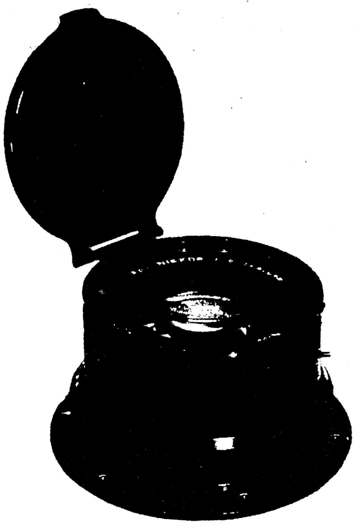
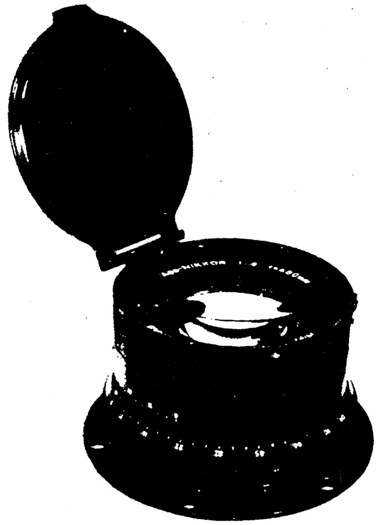

420mm f/9

Table 4 **Iris Diaphragm**

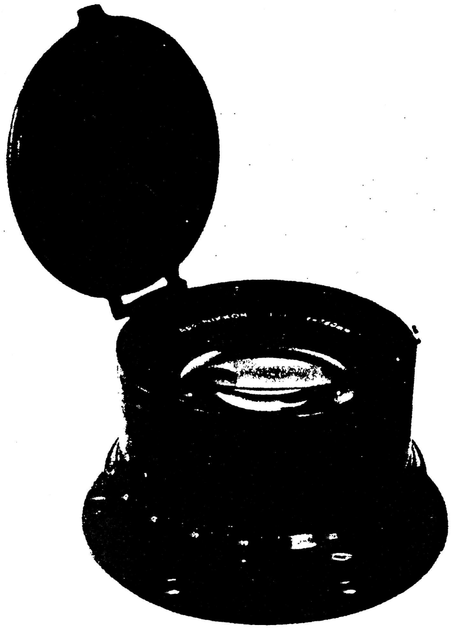
Focal length		Circular opening type diaphragm			Square opening type diaphragm				
		Aperture range	Minimum marking	Range of equidistant marking	Aperture range	Minimum marking	Range of equidistant marking	Rotating angle	Minimum angular marking
240mm	9 1/2″	9—128	1/3 stop	9—90	—	—	—	—	—
360	14	9—128	〃	9—90	16—64	1/3 stop	16—64	0—90°	5°
420	16 1/2	9—128	〃	9—90	—	—	—	—	—
480	19	9—128	〃	9—90	—	—	—	—	—
610	24	9—128	〃	9—90	—	—	—	—	—
760	30	11—128	〃	11—90	—	—	—	—	—

TYPE OF LENSES / DESCRIPTION	480mm f/9	610mm f/9	760mm f/11
Focal length	483mm	609.6mm	762mm
Max. aperture	f/9	f/9	f/11
Construction	4 elements 4 groups	4 elements 4 groups	4 elements 4 groups
Picture angle	46°	46°	42°
Standard magnification	1×	1×	1×
Range of magnification	1/∞—∞	1/∞—∞	1/∞—∞
Overall working distance	1,920mm	2,440mm	3,040mm
Object area (at 1:1)	800mm	1,010mm	1,170mm
Image area (at 1:1)	800mm	1,010mm	1,170mm
Correction wavelength range	380—750mμ	380—750mμ	330—750mμ
Vignetting	0% at f/16	0% at f/16	0% at f/16
Aperture scale	9—128	9—128	11—128
Mount	Screw d=90mm p=1mm	Screw d=110mm p=1mm	Screw d=110mm p=1mm
Dimensions max. diameter	105mm	127mm	127mm
max. length	74mm	92.5mm	89.6mm
Weight	775g	1,400g	1,280g



480mm f/9

610mm f/9



760mm f/11

Table 5 **Waterhouse Plate and Slot**

Focal length		Circle circumscribing the largest square engraving on waterhouse plate	Range of adjustment of rotating angle of waterhouse plate	Maximum aperture ratio in inserting gelatine filter
240mm	9 1/2″	f/16, f/22, f/32 (f/64)	0—90°	f/9
360	14	none	0—90°	f/12.5
420	16 1/2	none	0—90°	f/10
480	19	f/22, f/32, f/45 (f/64)	0—90°	f/12.5
610	24	f/22, f/32, f/45, f/64, f/90	0—90°	f/12.5
760	30	f/22, f/32, f/45, f/64, f/90	0—90°	f/12.5

Asymmetrical Type Apo-Nikkor

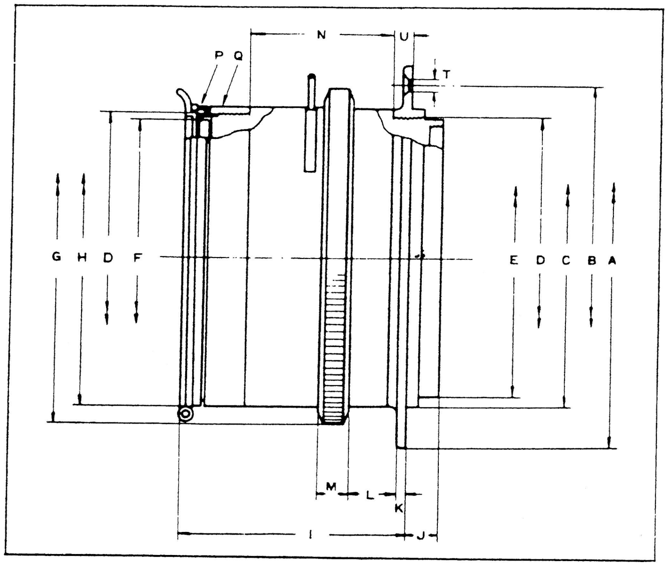


Fig. 3 **Diagram for Asymmetrical Type Apo-Nikkor 150mm—900mm**

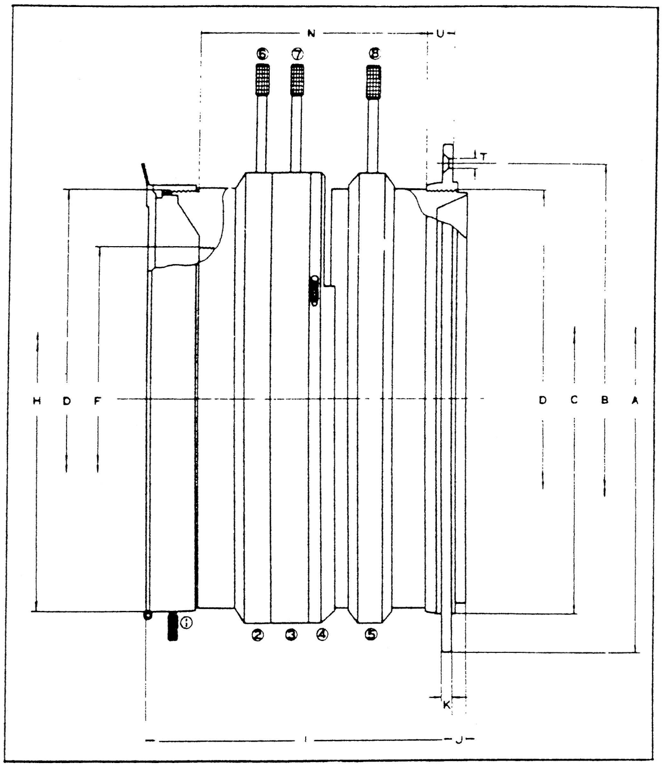


Fig. 4 **Diagram for Asymmetrical Type Apo-Nikkor 1,200mm and 1,800mm**

1. Lock for front cap
2. Rotary angle ring for square type iris diaphragm
3. Square type iris diaphragm ring
4. Slit for inserting waterhouse plate
5. Circular type iris diaphragm ring
6. Lock for square type iris diaphragm ring
7. Square type iris diaphragm knob
8. Circular type iris diaphragm knob

300mm f/9

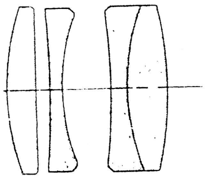


Table 6 **Asymmetrical Type** (Unit: mm)

Asymmetrical type Apo-Nikkor	Dimensions of lens barrel																Diaphragm ring rotating angle	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	T	U	Circular opening	Square opening
150mm f/9	74	67	55	53×0.75	50	47×0.5	62	55	37.2	8.5	2.5	8	8	19	2.6	3	75°	Not Provided
210mm f/9	74	67	55	53×0.75	50	47×0.5	62	55	35.2	8.5	2.5	1	8.1	17	2.6	3	75°	〃
300mm f/9	74	67	55	53×0.75	50	47×0.5	62	55	36.7	8.5	2.5	1.5	6	18.5	2.6	3	83°48′	〃
450mm f/9	98	88	74.5	72×1	70	68×0.75	86	74.5	53	6	3	4.5	12	32.5	4	5	86°05′	〃
600mm f/9	121	109	94	90×1	88	86×0.75	106	94	72	10	3	12.5	12	45	4	6	87°23′	〃
750mm f/9	145	131	114	110×1	108	104×0.75	128	114	86.1	11.7	4	14	14	55.3	4	8	90°25′	〃
900mm f/9	188	169	145	140×1.5	137.4	132×1	158	145	95	12.5	4.5	15.5	14	66	5	6.5	89°9′	〃
1,200mm f/9	260	240	220	213×1.5	—	155×1	—	218	160.6	7.5	5	—	—	121.5	5	12.5	120°	32°50′
1,800mm f/14	260	240	220	213×1.5	—	155×1	—	218	204.3	6	5	—	—	166.9	5	12.5	114°	36°4′

TYPE OF LENSES DESCRIPTION	150mm f/9	210mm f/9	300mm f/9
Focal length	150mm	210mm	300mm
Max. aperture	f/9	f/9	f/9
Construction	4 elements	4 elements	4 elements
	3 groups	3 groups	3 groups
Picture angle	45°	45°	41°
Standard magnification	1×	1×	1×
Range of magnification	1/∞ − ∞	1/∞ − ∞	1/∞ − ∞
Overall working distance	600mm	840mm	1,200mm
Object area (at 1:1)	250mmφ	350mmφ	450mmφ
Image area (at 1:1)	250mmφ	350mmφ	450mmφ
Correction wavelength range	380—750mμ	380—750mμ	380—750mμ
Vignetting	0% at f/16	0% at f/16	0% at f/16
Distortion	−0.2%	−0.2%	−0.2%
Aperture scale	9−90	9−90	9−90
Mount	Screw	Screw	Screw
	d=53mm p=0.75mm	d=53mm p=0.75mm	d=53mm p=0.75mm
Dimensions max. diameter	62mm	62mm	62mm
max. length	45.5mm	44.5mm	45.5mm
Weight	175g	185g	240g

TYPE OF LENSES DESCRIPTION	450mm f/9	600mm f/9	750mm f/9
Focal length	450mm	600mm	750mm
Max. aperture	f/9	f/9	f/9
Construction	4 elements	4 elements	4 elements
	3 groups	3 groups	3 groups
Picture angle	37°	37°	37°
Standard magnification	1×	1×	1×
Range of magnification	1/∞ − ∞	1/∞ − ∞	1/∞ − ∞
Overall working distance	1,800mm	2,400mm	3,000mm
Object area (at 1:1)	600mmφ	800mmφ	1,000mmφ
Image area (at 1:1)	600mmφ	800mmφ	1,000mmφ
Correction wavelength range	380—750mμ	380—750mμ	380—750mμ
Vignetting	0% at f/16	0% at f/16	0% at f/16
Distortion	−0.2%	−0.2%	−0.2%
Aperture scale	9−90	9−90	9−90
Mount	Screw	Screw	Screw
	d=72mm p=1mm	d=90mm p=1mm	d=110mm p=1mm
Dimensions max. diameter	86mm	106mm	130mm
max. length	59mm	82mm	97.7mm
Weight	550g	775g	2,015g

TYPE OF LENSES DESCRIPTION	900mm f/9	1,200mm f/9	1,800mm f/14
Focal length	900mm	1,200mm	1,800mm
Max. aperture	f/9	f/9	f/14
Construction	4 elements	4 elements	4 elements
	3 groups	3 groups	4 groups
Picture angle	37°	37°	35° 20′
Standard magnification	1×	1×	1×
Range of magnification	1/∞ − ∞	1/∞ − ∞	1/∞ − ∞
Overall working distance	3,600mm	4,800mm	7,200mm
Object area (at 1:1)	1,200mmφ	1,600mmφ	2,300mmφ
Image area (at 1:1)	1,200mmφ	1,600mmφ	2.300mmφ
Correction wavelength range	380—750mμ	380—750mμ	380—750mμ
Vignetting	0% at f/16	0% at f/16	0% at f/22
Distortion	−0.15%	−0.1%	−0.1%
Aperture scale	9−90	9−90	14−128
Mount	Screw	Screw	Screw
	d=140mm p=1.5mm	d=213mm p=1.5mm	d=213mm p=1.5mm
Dimensions max. diameter	158mm	233mm	233mm
max. length	123.5mm	168.5mm	210.5mm
Weight	3,570g	8,385g	8,860g